



Mitigation Options

Projects Eligible for FEMA Commonwealth Funding

Project Options

- **Structural Mitigation Methods**

- HMGP, FMA, PDM, RFC, SRL
 - Project Types
 - Wind
 - Flood

- **Planning Projects**

- HMGP (7%)
- FMA
- PDM

- **Initiative Projects**

- HMGP (5%)



Poquoson, September 18, 2003



Mitigation is:

Any sustainable action that reduces risk from natural or human-caused hazards of

- *injury to people,*
- *damage to property, and*
- *maintains continuity of critical societal functions.*



Structural Mitigation

- Wind
- Flood
- Coastal
- Tornado
- Wildfire
- Earthquake



Wind Mitigation Methods



Debris Removal



Strengthen the Roof



Reinforce Gable Ends



Ensure Proper Connections



Protect Openings



Safe Rooms

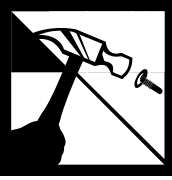




Protecting from Windborne Debris

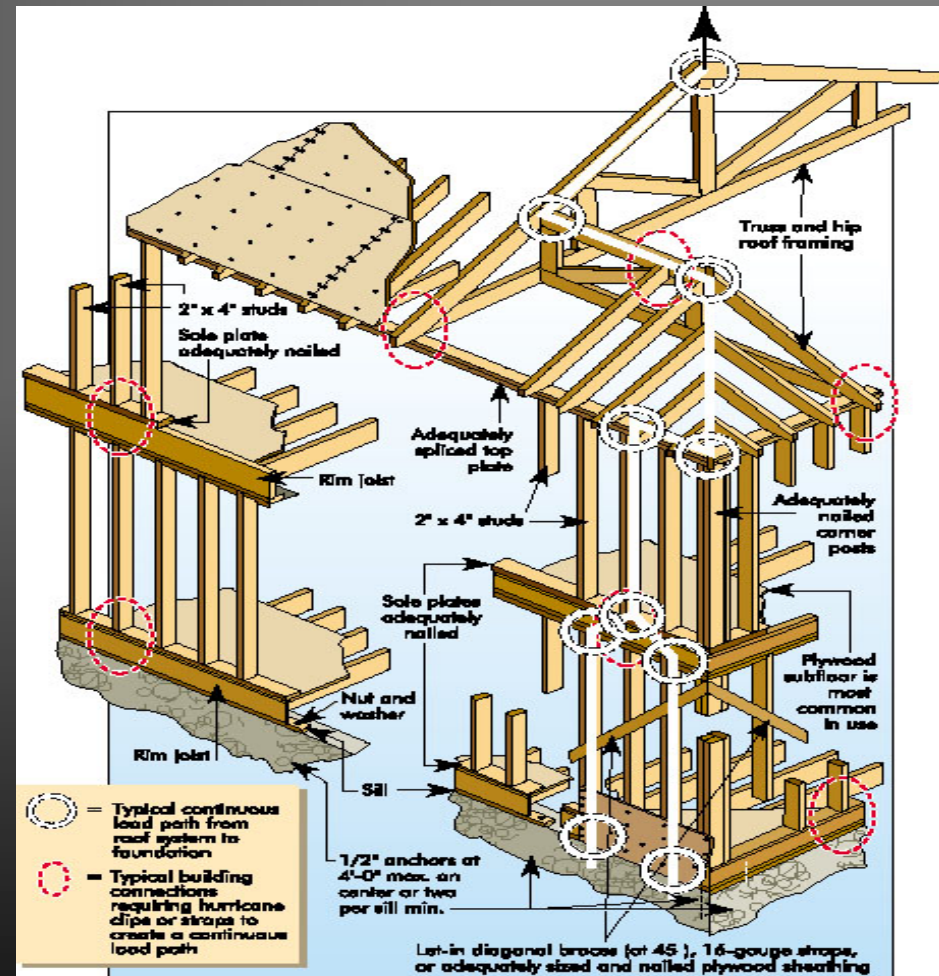
- Eliminate Debris Sources
 - Properly anchor and secure manufactured homes
- Protect Openings
 - Especially garage and patio doors or any other large openings with shutters and shields.





The Continuous Load Path

- Holds the building envelope together
- Transmits wind forces to foundation
- Roof connections are essential





Keeping the Roof On

- Proper Sheathing Attachment
- Gable-end Reinforcement
- Continuous Load Path to Ground





Gable-End Bracing

- Failure leads to roof collapse
- Gable end collapse was the most common failure during Hurricane Andrew
- Gable ends can be reinforced



Florida, Ivan 2004



Protecting Openings

The Most Vulnerable Openings

- Double Garage Doors
- Patio Doors
- Windows
- Double Entry Doors





Hurricane Shutters in Virginia

- Following Bonnie, Dennis and Floyd, Home Depot stocked shutters
- Only four pairs were sold
- Cost-effective method to preserve building envelope



VA Beach HMGP Shutter Project





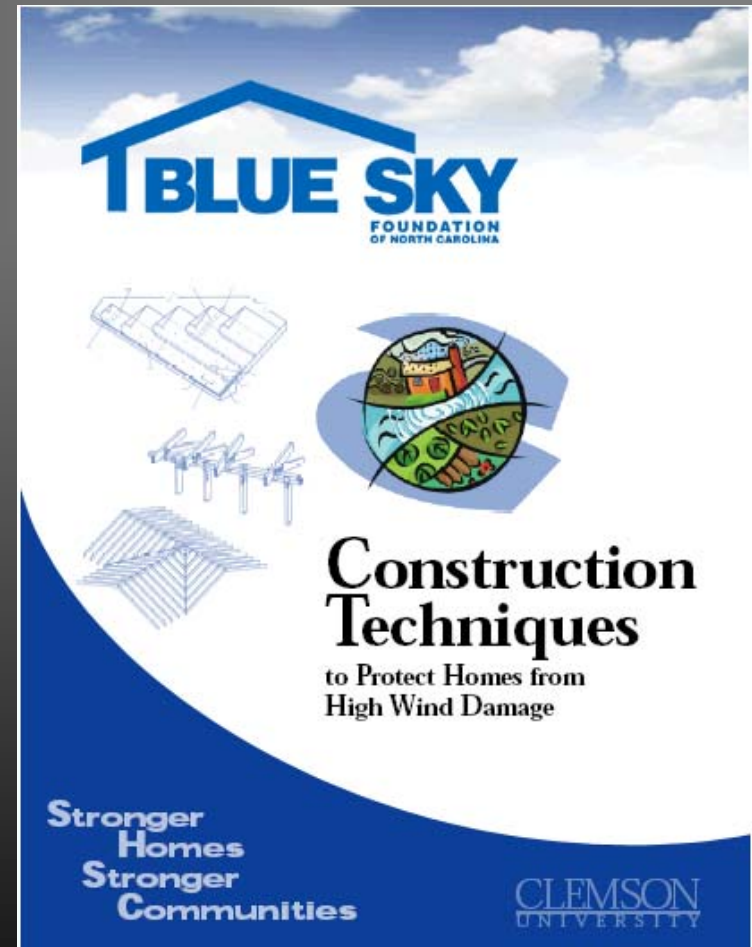
Safe Rooms and Community Shelters

“A safe place to go. . .
with time to get there”



Construction Guides

- Many publications available at www.bluesky-foundation.net
- Construction techniques for up to 140-mph, 3-sec gust wind resistance
- Also on www.fema.gov



Flood Mitigation Methods



Acquisition



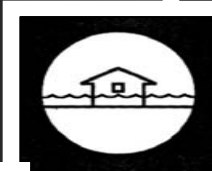
Elevation



Relocation



Dry Floodproofing



Wet Floodproofing



Infrastructure Protection



Acquistion/Demolition



Bluefield



Chesapeake

After

Elevation



Isle of Wight
County



Poquoson



Elevation Projects



Franklin Virginia

Franklin City Hall



Elevated on Fill after Floyd



Relocation





Flood Proofing



Floodproofing can be appropriate for:

- Pre-FIRM structures
- **Non-residential buildings**
- Structures at/near the landward edge of the Coastal A Zone
- Structures subject to low-level flooding depths of 2 feet or less (short duration)
- Structures where it is not economical to elevate or relocate





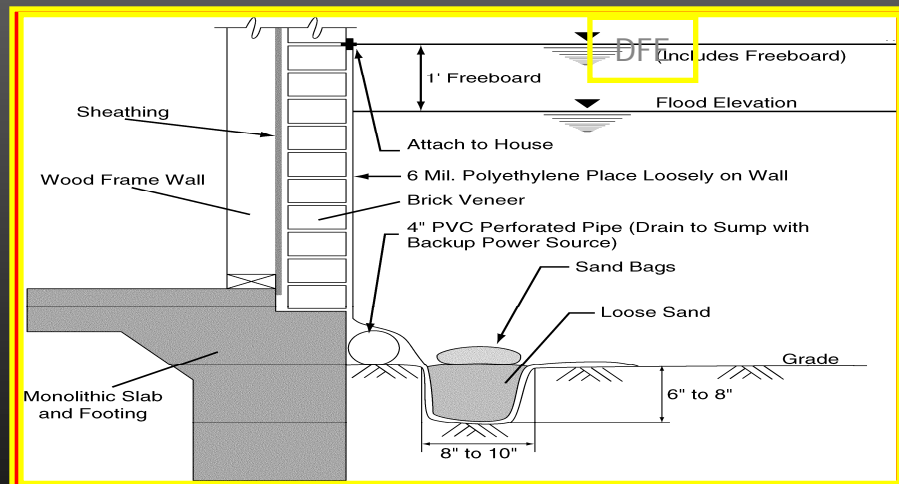
Dry Flood proofing

Making a structure water-tight so that water will not enter the foundation of the building.

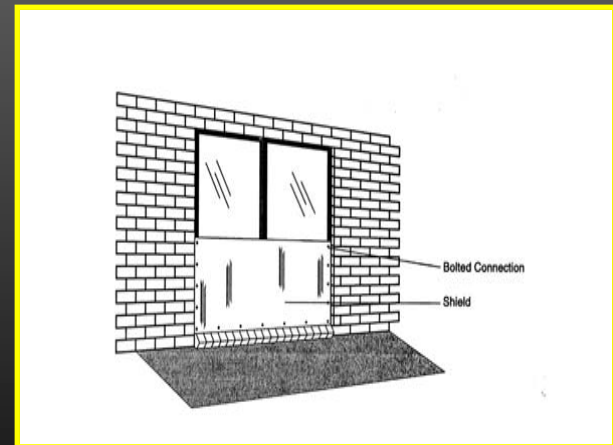


Dry Floodproofing Measures

- Watertight shields for doors and windows
- Reinforcement of walls
- Membranes and other sealants
- Drainage collection systems and sump pumps
- Check valves
- Anchoring



Examples of “Dry” Flood proofing



Dry Floodproofing Applications

- Short duration flooding
- Low velocity flooding
- Depth less than 3 feet (including 1 foot freeboard)
- NFIP compliant for non-residential structures only
- Masonry block or brick veneer walls (recommended)



Dry Floodproofing Pitfalls

- Active mitigation
- Increases buoyancy
- Increases lateral forces potential
- Potential for total building failure
- Power dependency (sump pump)
- Maintenance requirements –
application requires a maintenance plan!





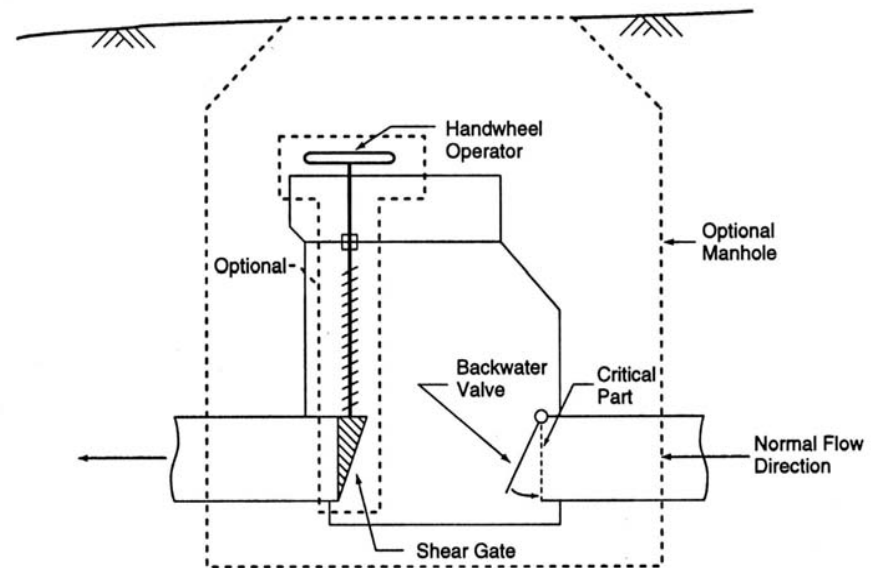
Wet Floodproofing



8-21-2008

What is “Wet” Flood proofing

Retrofit of a structure to allow entry of rising water through the building.



Wet Floodproofing Techniques

- Openings
- Flood resistant materials
- Protect equipment (HVAC, electric, fuel, water, wastewater)
 - Elevate
 - Protect in place
- Modify surfaces for easy cleanup
- *Requires Operation & Maintenance Plan*



Wet Floodproofing Applications



- Short duration flooding
- Low velocity flooding
- Depth less than 3 feet (including 1 foot freeboard)
- **NFIP compliant for non-residential structures only**

Wet Floodproofing Pitfalls

- Active mitigation
- Potential for damage and clean up remains
- Maintenance requirements



Mitigation Projects

- Must be holistic and address all weaknesses of the building;
- Design concepts, and engineering specifications as complete as possible must be included;
- Make sure the Scope of Work tells the complete story of the structure(s), its purpose and its vulnerabilities.



The Preservation of the Past is an Investment in our Future



THE DARLINGTON MITIGATION STORY

Darlington WI Downtown Mitigation Project

- Devastation from early 1990's floods
- 10-year progressive mitigation plan
- Preserved downtown business area
- Maintained historic designation

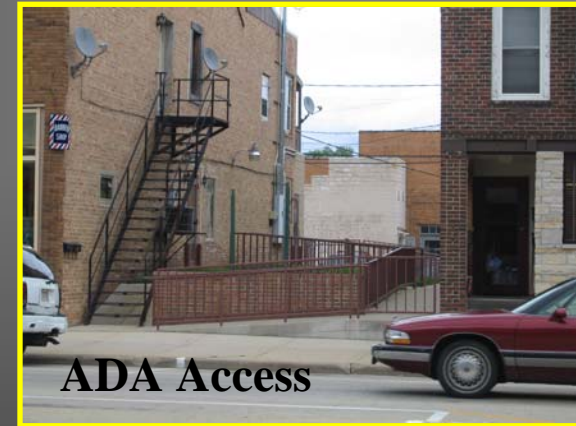


Downtown Mitigation

- Appropriate use of Special Flood Hazard Area
- Flood-proofed mechanicals



Business Floodproofing



Preservation of Historic Business District



Abandon Basement, Elevate within First Floor



First Floor Entry and Display Area



A Closer Look...



8-21-2008

Interior Elevation & Flood Shields, Reconstruction on Fill



Utility Flood Proofing





Infrastructure Protection Techniques

- Backflow prevention
- Watertight manholes
- Upsize drainage structure





Infrastructure Protection



Railroad drainage check
Valves Vinton, Virginia

Infrastructure Flood Proofing



Design Flood Elevation



City of Franklin Sewage Treatment Plant



Multi-hazard Mitigation Methods



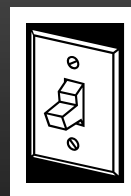
Auxiliary Pump Quick Connects



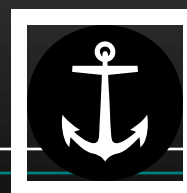
Generator Quick Connects



Standby Generator



Transfer Switch



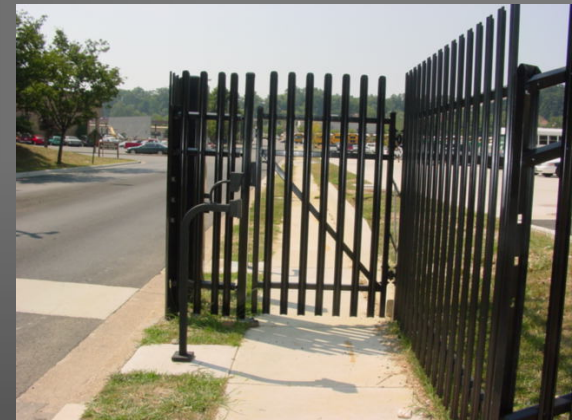
Anchoring



Pentagon 9-11 HMGP Projects

Arlington County

- Planning
- Barriers
- Cameras
- Shields



Mitigation/Floodproofing Cautions

- Substantial Damage
- Zoning & Code Regulations
- Occupancy
- Experienced professionals
- Maintenance
- Level of protection
- Flood insurance



**NATIONAL
FLOOD
INSURANCE
PROGRAM**